IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent application of:

Applicant(s):	Andreas Manz et al.
Serial No.:	10/559,958
Filed:	June 30, 2006
Title:	FREE FLOW ELECTROPHORESIS MICROCHIP, SYSTEM AND METHOD
Examiner:	John C. Ball
Art Unit:	1795
Docket No.	FRYHP0184US

APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The undersigned submits this brief for the Board's consideration of the appeal of the Examiner's decision, mailed July 13, 2010, finally rejecting claims 1-12, 15-50, 53-81 and 84-99 of the above-identified application.

The fee for filing an appeal brief is being paid herewith. In the event an additional fee or further extension of time is necessary, the Commissioner is authorized to charge any additional fee which may be required, and further to consider this a petition for an extension of time to make the filing of this brief timely, to Deposit Account No. 18-0988 under Docket No. FRYHP0184US.

I. Real Party in Interest

The real party in interest in the present appeal is Andreas Manz and Chao-Xuan Zhang.

II. Related Appeals and Interferences

Neither appellant nor appellant's legal representative are aware of any appeals or interferences which will directly affect, which will be directly affected by, or which will have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1-12, 15-50, 53-81 and 84-99 have been finally rejected and claims 13, 14, 51, 52, 82 and 83 have been canceled. The claims on appeal are claims 1-12, 15-50, 53-81 and 84-99, and a correct copy of these claims is reproduced in the Claims Appendix.

IV. Status of Amendments

No claim amendments were filed subsequent to the issuance of the final Office Action, from which this appeal is taken.

V. Summary of Claimed Subject Matter

The following is a concise explanation of the subject matter defined in each of the independent claims involved in the appeal, which refers to the specification by page and line number in brackets, and to the drawing by reference characters.

Claim 1

A free flow electrophoresis microchip, comprising:

a separation chamber (5) comprising a planar chamber having a planar region in which charged components are in use separated [page 1, lines 21 and 22; page 13, lines 6-11; and page 18, lines 17-23];

a plurality of separation medium inlet channels (9) having outlets fluidly connected to one, inlet side of the separation chamber (5) through which flows of a separation medium are in use introduced into the separation chamber (5) such as to develop a laminar flow having a flow direction through the separation chamber (5) [page 1, lines 22-26; page 13, lines 15-26; and page 18, line 27-page 19, line 5];

a sample inlet channel (7) having an outlet fluidly connected to the inlet side of the separation chamber (5) through which a flow of a sample containing charged components is in use introduced into the separation chamber (5) [page 1, lines 26-28; page 13, lines 15-26; and page 18, line 27-page 19, line 5];

a plurality of outlet channels (17) having inlets fluidly connected to another, outlet side of the separation chamber (5) opposite the inlet side thereof [page 1, lines 29 and 30; page 14, lines 12-16; and page 19, lines 25-29]; and

a magnetic field unit (31) for providing a magnetic field substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium [page 1, lines 30-32; page 15, 6-11; page 20, lines 20-25; page 22, lines 1-7; and page 23, lines 18-23];

whereby charged components introduced into the separation chamber (5) are deflected laterally across the separation chamber (5) in dependence upon the charge of

the charged components [page 1, line 32-page 2, line 2; page 13, lines 28-32; and page 19, lines 7-11].

Claim 39

A free flow electrophoresis method of separating charged components, the method comprising the steps of:

providing a free flow electrophoresis microchip, comprising: a separation chamber (5) comprising a planar chamber having a planar region in which charged components are separated [page 5, lines 27-29; page 13, lines 15-32; and page 18, line 26-page 19, line 11];

a plurality of separation medium inlet channels (9) having outlets fluidly connected to one, inlet side of the separation chamber (5) [page 5, lines 29 and 30; page 13, lines 15-26; and page 18, line 27-page 19, line 5]; a sample inlet channel (7) having an outlet fluidly connected to the inlet side of the separation chamber (5) [page 5, lines 30 and 31; page 13, lines 15-26; and page 18, line 27-page 19, line 5];

a plurality of outlet channels (17) having inlets fluidly connected to another, outlet side of the separation chamber (5) opposite the inlet side thereof [page 5, lines 31-33; page 14, lines 12-16; and page 19, lines 25-29];

a magnetic field unit (31) for providing a magnetic field in a direction substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium [page 5, line 33-page 6, line 2; page 15, 6-11; page 20, lines 20-25; page 22, lines 1-7; and page 23, lines 18-23]; and

first and second electrode units (21 and 23) disposed at respective ones of other, lateral sides of the separation chamber (5) [page 6, lines 2 and 3; page 14, lines 21-24; and page 20, lines 1-4]; and

applying a potential between the electrode units (21 and 23) so as to generate an electric field across the separation chamber (5) in a direction substantially orthogonal to the magnetic field direction, wherein the electric field acts together with the magnetic field to induce a magnetohydrodynamic flow of sample and separation medium through the separation chamber (5), and deflect the charged components laterally across the separation chamber (5) in dependence upon the charge of the charged components [page 6, lines 3-9; page 16, lines 30-32; page 15, lines 13-16; and page 23, lines 18-23].

Claim 68

A free flow electrophoresis method of separating charged components, the method comprising the steps of:

providing a free flow electrophoresis microchip, comprising: a separation chamber (5) comprising a planar chamber having a planar region in which charged components are separated [page 8, lines 31-33; page 13, lines 15-32; and page 18, line 26-page 19, line 11];

a plurality of separation medium inlet channels (9) having outlets fluidly connected to one, inlet side of the separation chamber (5) [page 8, line 33-page 9, line 1; page 13, lines 15-26; and page 18, line 27-page 19, line 5];

a sample inlet channel (7) having an outlet fluidly connected to the inlet side of the separation chamber (5) [page 9, lines 1 and 2; page 13, lines 15-26; and page 18, line 27-page 19, line 5];

a plurality of outlet channels (17) having inlets fluidly connected to another, outlet side of the separation chamber (5) opposite the inlet side thereof [page 9, lines 2-4; page 14, lines 12-16; and page 19, lines 25-29]; and

a magnetic field unit (31) for providing a magnetic field in a direction substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium [page 9, lines 4-6; page 15, 6-11; page 20, lines 20-25; page 22, lines 1-7; and page 23, lines 18-23]; and

supplying flows of sample and separation medium through the respective ones of the sample inlet channel (7) and the separation medium inlet channels (9) into and through the separation chamber (5), wherein the flow of separation medium acts together with the magnetic field to induce an electric field across the separation chamber (5) in a direction substantially orthogonal to the flow direction, which electric field acts to deflect the charged components laterally across the separation chamber (5) in dependence upon the charge of the charged components [page 9, lines 6-13; and page 23, lines 18-23].

VI. Grounds of Objection/Rejection to Be Reviewed on Appeal

Claims 1-12, 15-50, 53-81 and 84-89 stand rejected under 35 U.S.C. § 103(a) as being obvious over an article by Raymond et al. (herein "Raymond") in view of U.S. Patent Publication No. 2003/0159999 (herein "Oakey").

VII. Argument

The rejections advanced by the Examiner are improper and should be reversed for at least the following reasons.

Rejection of claims 1-12, 15-50, 53-81 and 84-89 under 35 U.S.C. § 103(a)

Claims 1-12, 15-50, 53-81 and 84-89 stand rejected under 35 U.S.C. § 103(a) as being obvious over Raymond in view of Oakey.

The Examiner's remarks in support of the rejection are as follows:

> Regarding claim 1, RAYMOND teaches a free flow electrophoresis microchip, comprising:
> a separation chamber comprising a planar chamber (Figure 3) having a planar region (separation bed, Figure 3), in which charged components are in use separated (separation bed, Figure 3);
> a plurality of separation medium inlet channels having outlets fluidly connected to one inlet side of the separation chamber (1 and 2, Figure 2; left carrier inlet and right carrier inlet, Figure 3) through which flows of a separation medium are in use introduced into the separation chamber such as to develop a laminar flow (second paragraph, Silicon Device section, p. 2860) having a flow direction through the separation chamber (carrier flow indication, Figure 1);
> a sample inlet channel having an outlet fluidly connected to the inlet side of the separation chamber (3, Figure 2; sample inlet, Figure 3) through which a flow of sample containing charged components is in use introduced into the separation chamber (first paragraph, Amino Acid Separation section, p. 2863; Figure 1); and
> whereby charged components introduced into the separation chamber are deflected laterally across the separation chamber in dependence upon the charge of the charged components (Figure 1).
> RAYMOND suggests a plurality of outlet channels having inlets fluidly connected to another outlet side of the separation chamber opposite the inlet side thereof (second paragraph, Silicon Device section, p. 2860), although this design was not utilized in the described invention to simplify fabrication of the initial device.
> RAYMOND doe not teach a magnetic field unit.
> However, OAKEY discloses a microfluidic device, wherein is taught a magnetic field unit for providing a magnetic field substantially orthogonal, wherein the magnetic field is directed substantially orthogonally to a planar region of a microchannel (44 and 92, Figure 3), to

> the flow direction of a separation medium in a microfluidic format (92, Figure 3; paragraph [0058]).
>
> At the time of the present invention, it would have been obvious to one of ordinary skill in the art to modify the device as described by RAYMOND with the addition of the magnetic field unit as taught by OAKEY because it would allow use of surface charge to be observed for distinguishing a particular particle in a sample (OAKEY, paragraph [0047]).

Office Action dated July 13, 2010, pages 3 and 4.

Reversal of the rejection is respectfully requested for at least the following reasons.

Claim 1

Claim 1 recites, *inter alia*, a free flow electrophoresis microchip which comprises a planar separation chamber having a planar region, and a magnetic field unit for providing a magnetic field substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium.

The Examiner contends that Raymond discloses a free flow electrophoresis device. The Examiner has acknowledged that Raymond does not teach a magnetic field unit as required by claim 1. In this regard, the Examiner has cited Oakey, and specifically identified the disclosure of a field generator (92) which induces an electric or magnetic field in a microfluidic device (44) [paragraph [0058], lines 5 to 7 and Figure 3 (reproduced below)], and is alleging that it would have been obvious to the skilled person to modify the microfluidic device of Raymond to incorporate a field generator (92) of the kind of Oakey. This is absolutely not the case.

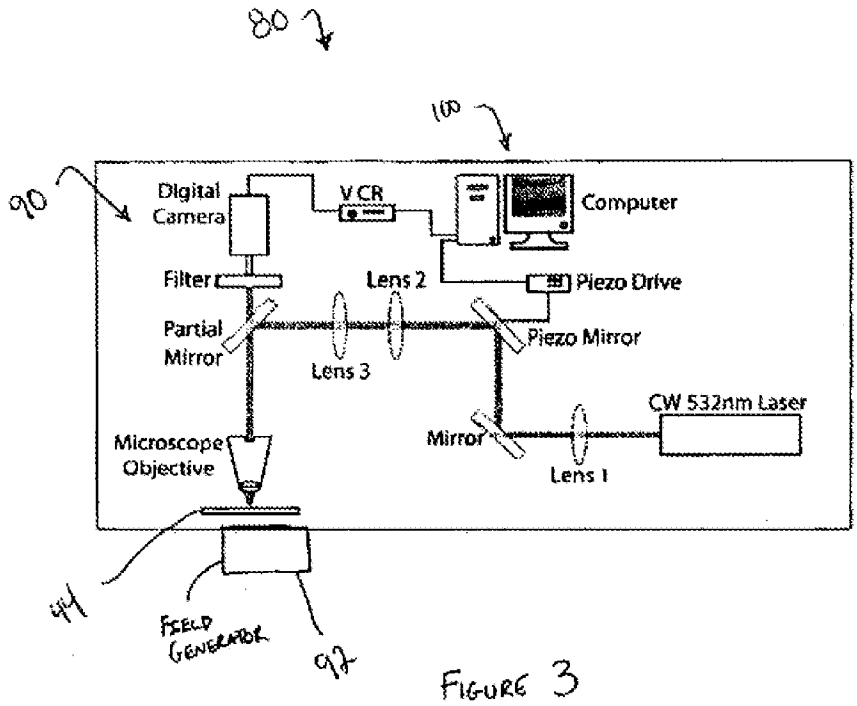

FIGURE 3

Firstly, and significantly, Oakey teaches that the field generator (92) is a component of an imaging system (90), which is separate to the microfluidic devices (44) which are to be imaged by the imaging system (90).

The teaching of Oakey is to identify particles by reference to electric or magnetic properties of the particles or properties associated with a pre-treatment of the particles using the imaging system (90), which induces an electric or magnetic field in the microfluidic device (44) to allow the particles to be imaged [paragraph [0058], lines 7 to 12].

Given this teaching, the skilled person would have had no conceivable reason to contemplate the implementation of the field generator (92) of Oakey within a microfluidic device, such as of the kind of Raymond.

The Examiner has commented that the motivation of the skilled person would be to enable a particle in a suspension to be distinguished based on surface charge.

Whilst the surface charge of a particle may be used to distinguish a particle, this teaching in Oakey provides no motivation whatsoever to implement the field generator of Oakey within the microfluidic device of Raymond.

This notwithstanding, it is submitted that, even if the skilled person were to have contemplated applying the teaching of Oakey to that of Raymond, the microfluidic device as recited in claim 1 would not result.

In Oakey, the purpose of the field generator (92) is to induce lateral movement of the particles of interest across the field of view of the microscope of the imaging system (90) [paragraph [0058], lines 7 to 12 and Figure 3], so as to enable this movement to be captured and thereby enable the particles of interest to be identified.

If the field generator (92) of Oakey were to be incorporated into the microfluidic device of Raymond, which has a planar separation bed, the field generator (92) would be required to induce a field transversely across the separation bed, that is, parallel to the separation bed and not substantially orthogonal to the planar separation bed as recited in claim 1, in order to induce lateral movement of the particles of interest across the field of view of the microscope of the imaging system (90).

The Examiner has commented that the field generator (92) of Oakey is located below the microfluidic device (44), and is alleging that it follows from this arrangement that the field must therefore be substantially orthogonal to the flow direction. There is absolutely no basis for this allegation, which, it is submitted, is manifestly based on an impermissible hindsight analysis of the disclosure of Oakey. The fact that a schematically-represented field generator (92) is drawn below a microfluidic device (44) does not infer any direction on the generated field.

As indicated above, in Oakey, the purpose of the field generator (92) is to induce lateral movement of the particles of interest across the field of view of the microscope of the imaging system (90), as otherwise this movement could not be captured, and so consequently the skilled person would clearly understand from Oakey that the field generator (92) in Oakey is required to induce a field transversely across the separation bed. To allege otherwise would require an impermissible hindsight analysis of Oakey.

Entirely differently from Oakey, the magnetic field employed in the microfluidic device of claim 1 is required to be orthogonal to the planar region of the separation chamber, in order to induce either a magnetohydrodynamic flow when provided in conjunction with an electric field or an electric field transverse to the separation chamber when provided in conjunction with a supplied flow through the separation chamber.

Therefore, for at least the foregoing reasons, the combination of Raymond and Oakey does not disclose the subject matter of claim 1 and the rejection should be reversed.

Claim 39

Claim 39 recites, *inter alia,* a free flow electrophoresis microchip which comprises a planar separation chamber having a planar region, and a magnetic field unit for providing a magnetic field in a direction substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium. For at least the same reasons discussed above regarding claim 1, the combination of Raymond and

Oakey does not disclose the subject matter of claim 39 and the rejection should be reversed.

Claim 68

Claim 68 recites, inter alia, a free flow electrophoresis microchip which comprises a planar separation chamber having a planar region, and a magnetic field unit for providing a magnetic field in a direction substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium. For at least the same reasons discussed above regarding claim 1, the combination of Raymond and Oakey does not disclose the subject matter of claim 68 and the rejection should be reversed.

VIII. Conclusion

In view of the foregoing, it is respectfully submitted that the claims are patentable over the applied art and that the rejections advance by the Examiner should be reversed.

Respectfully submitted,

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Claims Appendix

1. A free flow electrophoresis microchip, comprising:

a separation chamber comprising a planar chamber having a planar region in which charged components are in use separated;

a plurality of separation medium inlet channels having outlets fluidly connected to one, inlet side of the separation chamber through which flows of a separation medium are in use introduced into the separation chamber such as to develop a laminar flow having a flow direction through the separation chamber;

a sample inlet channel having an outlet fluidly connected to the inlet side of the separation chamber through which a flow of a sample containing charged components is in use introduced into the separation chamber;

a plurality of outlet channels having inlets fluidly connected to another, outlet side of the separation chamber opposite the inlet side thereof; and

a magnetic field unit for providing a magnetic field substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium;

whereby charged components introduced into the separation chamber are deflected laterally across the separation chamber in dependence upon the charge of the charged components.

2. The microchip of claim 1, wherein the outlets of the separation medium inlet channels are disposed in spaced relation along the inlet side of the separation chamber.

3. The microchip of claim 1, wherein the outlet of the sample inlet channel is disposed in a central region of the inlet side of the separation chamber.

4. The microchip of claim 1, wherein the outlet of the sample inlet channel is disposed in an end region of the inlet side of the separation chamber.

5. The microchip of claim 1, wherein the outlets of the sample inlet channel and the separation medium inlet channels face in the same direction.

6. The microchip of claim 1, wherein the separation medium inlet channels are commonly fluidly connected.

7. The microchip of claim 1, wherein groups of ones of the separation medium inlet channels are commonly fluidly connected.

8. The microchip of claim 1, wherein the separation medium inlet channels are separately fluidly connected.

9. The microchip of claim 1, wherein the outlets of the sample inlet channel and the separation medium inlet channels are disposed in opposed relation to the inlets of the outlet channels.

10. The microchip of claim 1, wherein the inlets of the outlet channels have a depth at least as great as that of the separation chamber.

11. The microchip of claim 1, wherein the inlets of the outlet channels are disposed in spaced relation along the outlet side of the separation chamber.

12. The microchip of claim 11, wherein the inlets of the outlet channels are equi-spaced.

15. The microchip of claim 1, wherein the separation chamber has a depth of from about 5 µm to about 50 µm.

16. The microchip of claim 1, wherein the magnetic field unit comprises at least one magnet.

17. The microchip of claim 16, wherein the at least one magnet comprises a layer of magnetic material.

18. The microchip of claim 17, wherein the magnetic material comprises a Ni-Fe permalloy.

19. The microchip of claim 1, further comprising:

first and second electrode units disposed at respective ones of other, lateral sides of the separation chamber.

20. The microchip of claim 19, wherein the electrode units each comprise an electrolyte reservoir disposed adjacent the respective lateral side of the separation chamber for containing a volume of an electrolyte medium, and a plurality of connection channels fluidly connecting the electrolyte reservoir to the respective lateral side of the separation chamber.

21. The microchip of claim 20, wherein each electrolyte reservoir has substantially the same length as the separation chamber.

22. The microchip of claim 20, wherein the connection channels are disposed in spaced relation along the respective lateral sides of the separation chamber.

23. The microchip of claim 22, wherein the connection channels are equi-spaced.

24. The microchip of claim 20, wherein the connection channels have a width of from about 1 µm to about 5 µm.

25. The microchip of claim 20, wherein the electrode units each further comprise an electrode element disposed in the respective electrolyte reservoir.

26. A free flow electrophoresis separation system, comprising:

the free flow electrophoresis microchip of claim 19; and

a high-voltage supply for applying an electric field between the electrode units and across the separation chamber in a direction substantially orthogonal to the magnetic field;

whereby a magnetohydrodynamic flow of sample and separation medium is induced through the separation chamber.

27. A free flow electrophoresis separation system, comprising:

the free flow electrophoresis microchip of claim 1; and

a supply unit for supplying flows of sample and separation medium through the respective ones of the sample inlet channel and the separation medium inlet channels and into the separation chamber;

whereby an electric field is induced across the separation chamber in a direction substantially orthogonal to the flow direction.

28. The system of claim 27, wherein the supply unit comprises a first transfer unit fluidly connected to the sample inlet channel for delivering a flow of sample through the sample inlet channel and into the separation chamber, and at least one second transfer unit fluidly connected to the separation medium inlet channels for delivering flows of separation medium through the separation medium inlet channels and into the separation chamber.

29. The system of claim 28, wherein at least one of the first transfer unit and the at least one second transfer unit are operable to control flow rates of the sample and separation medium flows to the separation chamber.

30. The system of claim 28, wherein the at least one second transfer unit comprises a plurality of second transfer units fluidly connected to respective ones of the separation medium inlet channels.

31. The system of claim 30, wherein the plurality of second transfer units are fluidly connected to groups of ones of the separation medium inlet channels.

32. The system of claim 30, wherein the plurality of second transfer units are fluidly connected to separate ones of the separation medium inlet channels.

33. The system of claim 28, wherein each transfer unit comprises a delivery pump.

34. The system of claim 26, further comprising:

at least one collection unit fluidly connected to at least one of the outlet channels for collection of at least one separated component.

35. The system of claim 34, comprising:

a plurality of collection units fluidly connected to respective ones of the outlet channels for collection of a plurality of separated components.

36. The system of claim 26, further comprising:

a detection unit for detecting migration of at least one separated component through at least one of the outlet channels.

37. The system of claim 36, wherein the detection unit is configured to detect migration of separated components through a plurality of ones of the outlet channels.

38. The system of claim 37, wherein the detection unit is configured to detect migration of separated components through each of the outlet channels.

39. A free flow electrophoresis method of separating charged components, the method comprising the steps of:

providing a free flow electrophoresis microchip, comprising: a separation chamber comprising a planar chamber having a planar region in which charged components are separated;

a plurality of separation medium inlet channels having outlets fluidly connected to one, inlet side of the separation chamber; a sample inlet channel having an outlet fluidly connected to the inlet side of the separation chamber;

a plurality of outlet channels having inlets fluidly connected to another, outlet side of the separation chamber opposite the inlet side thereof;

a magnetic field unit for providing a magnetic field in a direction substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium; and

first and second electrode units disposed at respective ones of other, lateral sides of the separation chamber; and

applying a potential between the electrode units so as to generate an electric field across the separation chamber in a direction substantially orthogonal to the magnetic field direction, wherein the electric field acts together with the magnetic field to induce a magnetohydrodynamic flow of sample and separation medium through the separation chamber, and deflect the charged components laterally across the separation chamber in dependence upon the charge of the charged components.

40. The method of claim 39, wherein the outlets of the separation medium inlet channels are disposed in spaced relation along the inlet side of the separation chamber.

41. The method of claim 39, wherein the outlet of the sample inlet channel is disposed in a central region of the inlet side of the separation chamber.

42. The method of claim 39, wherein the outlet of the sample inlet channel is disposed in an end region of the inlet side of the separation chamber.

43. The method of claim 39, wherein the outlets of the sample inlet channel and the separation medium inlet channels face in the same direction.

44. The method of claim 39, further comprising the step of:

commonly introducing separation medium through the separation medium inlet channels.

45. The method of claim 39, further comprising the step of:

introducing different separation media through respective groups of ones of the separation medium inlet channels.

46. The method of claim 39, further comprising the step of:

introducing different separation media through respective ones of the separation medium inlet channels.

47. The method of claim 39, wherein the outlets of the sample inlet channel and the separation medium inlet channels are disposed in opposed relation to the inlets of the outlet channels.

48. The method of claim 39, wherein the inlets of the outlet channels have a depth at least as great as that of the separation chamber.

49. The method of claim 39, wherein the inlets of the outlet channels are disposed in spaced relation along the outlet side of the separation chamber.

50. The method of claim 49, wherein the inlets of the outlet channels are equi-spaced.

53. The method of claim 39, wherein the separation chamber has a depth of from about 5 µm to about 50 µm.

54. The method of claim 39, wherein the magnetic field unit comprises at least one magnet.

55. The method of claim 54, wherein the at least one magnet comprises a layer of magnetic material.

56. The method of claim 55, wherein the magnetic material comprises a Ni-Fe permalloy.

57. The method of claim 39, wherein the electrode units each comprise an electrolyte reservoir disposed adjacent the respective lateral side of the separation chamber for containing a volume of an electrolyte medium, and a plurality of connection channels fluidly connecting the electrolyte reservoir to the respective lateral side of the separation chamber.

58. The method of claim 57, wherein each electrolyte reservoir has substantially the same length as the separation chamber.

59. The method of claim 57, wherein the connection channels are disposed in spaced relation along the respective lateral sides of the separation chamber.

60. The method of claim 59, wherein the connection channels are equi-spaced.

61. The method of claim 57, wherein the connection channels have a width of from about 1 µm to about 5 µm.

62. The method of claim 57, wherein the electrode units each further comprise an electrode element disposed in the respective electrolyte reservoir.

63. The method of claim 39, further comprising the step of:

collecting at least one separated component from at least one of the outlet channels.

64. The method of claim 63, wherein the step of collecting at least one separated component comprises the step of:

collecting separated components from respective ones of the outlet channels.

65. The method of claim 39, further comprising the step of:

detecting migration of at least one separated component through at least one of the outlet channels.

66. The method of claim 65, wherein the step of detecting migration of at least one separated component comprises the step of:

detecting migration of separated components through a plurality of ones of the outlet channels.

67. The method of claim 66, wherein the step of detecting migration of at least one separated component comprises the step of:

detecting migration of separated components through each of the outlet channels.

68. A free flow electrophoresis method of separating charged components, the method comprising the steps of:

providing a free flow electrophoresis microchip, comprising: a separation chamber comprising a planar chamber having a planar region in which charged components are separated;

a plurality of separation medium inlet channels having outlets fluidly connected to one, inlet side of the separation chamber;

a sample inlet channel having an outlet fluidly connected to the inlet side of the separation chamber;

a plurality of outlet channels having inlets fluidly connected to another, outlet side of the separation chamber opposite the inlet side thereof; and

a magnetic field unit for providing a magnetic field in a direction substantially orthogonal to the planar region of the separation member and to the flow direction of the separation medium; and

supplying flows of sample and separation medium through the respective ones of the sample inlet channel and the separation medium inlet channels into and through the separation chamber, wherein the flow of separation medium acts together with the magnetic field to induce an electric field across the separation chamber in a direction substantially orthogonal to the flow direction, which electric field acts to deflect the charged components laterally across the separation chamber in dependence upon the charge of the charged components.

69. The method of claim 68, wherein the outlets of the separation medium inlet channels are disposed in spaced relation along the inlet side of the separation chamber.

70. The method of claim 68, wherein the outlet of the sample inlet channel is disposed in a central region of the inlet side of the separation chamber.

71. The method of claim 68, wherein the outlet of the sample inlet channel is disposed in an end region of the inlet side of the separation chamber.

72. The method of claim 68, wherein the outlets of the sample inlet channel and the separation medium inlet channels face in the same direction.

73. The method of claim 68, wherein the step of supplying sample and separation medium includes the step of:

commonly supplying separation medium through the separation medium inlet channels.

74. The method of claim 68, wherein the step of supplying sample and separation medium includes the step of:

supplying different separation media through respective groups of ones of the separation medium inlet channels.

75. The method of claim 68, wherein the step of supplying sample and separation medium includes the step of:

supplying different separation media through respective ones of the separation medium inlet channels.

76. The method of claim 68, wherein the step of supplying sample and separation medium comprises the step of:

delivering sample and separation medium flows through the respective ones of the sample inlet channel and the separation medium inlet channels and into the separation chamber.

77. The method of claim 68, wherein flow rates of the sample and separation medium flows are regulated to control the lateral deflection of the charged components.

78. The method of claim 68, wherein the outlets of the sample inlet channel and the separation medium inlet channels are disposed in opposed relation to the inlets of the outlet channels.

79. The method of claim 68, wherein the inlets of the outlet channels have a depth at least as great as that of the separation chamber.

80. The method of claim 68, wherein the inlets of the outlet channels are disposed in spaced relation along the outlet side of the separation chamber.

81. The method of claim 80, wherein the inlets of the outlet channels are equi-spaced.

84. The method of claim 68, wherein the separation chamber has a depth of from about 5 µm to about 50 µm.

85. The method of claim 68, wherein the magnetic field unit comprises at least one magnet.

86. The method of claim 85, wherein the at least one magnet comprises a layer of magnetic material.

87. The method of claim 86, wherein the magnetic material comprises a Ni-Fe permalloy.

88. The method of claim 68, wherein the microchip further comprises:

first and second electrode units disposed at respective ones of other, lateral sides of the separation chamber.

89. The method of claim 88, wherein the electrode units each comprise an electrolyte reservoir disposed adjacent the respective lateral side of the separation chamber for containing a volume of an electrolyte medium, and a plurality of connection channels fluidly connecting the electrolyte reservoir to the respective lateral side of the separation chamber.

90. The method of claim 89, wherein each electrolyte reservoir has substantially the same length as the separation chamber.

91. The method of claim 89, wherein the connection channels are disposed in spaced relation along the respective lateral sides of the separation chamber.

92. The method of claim 91, wherein the connection channels are equi-spaced.

93. The method of claim 89, wherein the connection channels have a width of from about 1 µm to about 5 µm.

94. The method of claim 89, wherein the electrode units each further comprise an electrode element disposed in the respective electrolyte reservoir.

95. The method of claim 68, further comprising the step of:

collecting at least one separated component from at least one of the outlet channels.

96. The method of claim 95, wherein the step of collecting at least one separated component comprises the step of:

collecting separated components from respective ones of the outlet channels.

97. The method of claim 68, further comprising the step of:

detecting migration of at least one separated component through at least one of the outlet channels.

98. The method of claim 97, wherein the step of detecting migration of at least one separated component comprises the step of:

detecting migration of separated components through a plurality of ones of the outlet channels.

99. The method of claim 98, wherein the step of detecting migration of at least one separated component comprises the step of:

detecting migration of separated components through each of the outlet channels.

Evidence Appendix

None.

Related Proceedings Appendix

None.